TABLES OF SUN-SPOT FREQUENCIES, 1901-1914.

Prof. A. WOLFER, Zurich.

The reader will find the first complete and revised series of both the observed and the smoothed Wolf-Wolfer relative sun-spot numbers in the MONTHLY WEATHER REVIEW, April, 1902, in Tables 1 and 2, on pages 173 and 176. On page 171 of that issue the significance of these numbers is explained by Prof. Wolfer as follows:

The *smoothed relative numbers* of Table 2 present the mean course of the spot phenomena; that is to say, without the numerous secondary short-period variations that really occur in addition to the 11-year variation. Investigations into the general course of the phenomena and into other periods should therefore be based upon these "*smoothed numbers*" and not on the "observed numbers." The method of formation of these numbers has been explained by Wolf in No. 42 of his Astronomische Mitteilungen.

It is also explained in the issue of the REVIEW mentioned, and the significance of his "relative numbers" is given in the REVIEW for November, 1901, page 505.

Prof. Wolfer has just published in the Meteorologische Zeitschrift for May, 1915, pages 193–195, the latest values for both the "observed" and the "smoothed" relative numbers, and has added to these Table 3, showing the epochs of sun-spot maxima and minima with the intervening periods. These three tables are here reprinted as in continuation of the tables published in the REVIEW of April, 1902.[1]—[C. A. jr.]

TABLE 1.—*Observed relative sun-spot numbers, Wolf-Wolfer system, 1901–1914.*

Year.	Jan. I.	Feb. II.	Mar. III.	Apr. IV.	May V.	June VI.	July VII.	Aug. VIII.	Sept. IX.	Oct. X.	Nov. XI.	Dec. XII.	Average.
1901...	0.2	2.4	4.5	0.0	10.2	5.8	0.7	1.0	0.6	3.7	3.8	0.0	2.7
1902...	5.2	0.0	12.4	0.0	2.8	1.4	0.9	2.3	7.6	16.3	10.3	1.1	5.0
1903...	8.3	17.0	13.5	26.1	14.6	16.3	27.9	28.8	11.1	38.9	44.5	45.6	24.4
1904...	31.6	24.5	37.2	43.0	39.5	41.9	50.6	58.2	30.1	54.2	38.0	54.6	42.0
1905...	54.8	85.8	56.5	39.3	48.0	49.0	73.0	58.8	55.0	78.7	107.2	55.5	63.5
1906...	45.5	31.3	64.5	55.3	57.7	63.2	103.3	47.7	56.1	17.8	38.9	64.7	53.8
1907...	76.4	108.2	60.7	52.6	43.0	40.4	49.7	54.3	85.0	65.4	61.5	47.3	62.0
1908...	39.2	33.9	28.7	57.6	40.8	48.1	39.5	90.5	86.9	32.3	45.5	39.5	48.5
1909...	56.7	46.6	66.3	32.3	36.0	22.6	35.8	23.1	38.8	58.4	55.8	54.2	43.9
1910...	26.4	31.5	21.4	8.4	22.2	12.3	14.1	11.5	26.2	38.3	4.9	5.8	18.6
1911...	3.4	9.0	7.8	16.5	9.0	2.2	3.5	4.0	4.0	2.6	4.2	2.2	5.7
1912...	0.3	0.0	4.9	4.5	4.4	4.1	3.0	0.3	9.5	4.6	1.1	6.4	3.6
1913...	2.3	2.9	0.5	0.9	0.0	0.0	1.7	0.2	1.2	3.1	0.7	3.8	1.4
1914...	2.5	2.6	3.1	17.3	5.3	11.4	5.4	7.8	12.8	8.1	16.1	22.2	9.6

TABLE 2.—*Smoothed relative sun-spot numbers, Wolf-Wolfer system, 1901–1914.*

Year.	Jan. I.	Feb. II.	Mar. III.	Apr. IV.	May V.	June VI.	July VII.	Aug. VIII.	Sept. IX.	Oct. X.	Nov. XI.	Dec. XII.	Average.
1901...	4.8	4.4	3.9	3.2	2.8	2.8	3.0	3.1	3.3	3.6	3.3	2.8	3.4
1902...	2.6	2.7	3.1	3.9	4.7	5.0	5.2	6.0	6.8	7.9	9.5	10.6	5.7
1903...	12.3	14.6	15.8	16.9	19.3	22.5	25.4	26.6	27.9	29.6	31.4	33.5	23.0
1904...	35.5	37.7	39.7	41.1	41.5	41.6	42.9	46.4	49.8	50.5	50.7	51.3	44.1
1905...	52.5	53.5	54.6	56.6	60.5	63.4	63.1	60.4	58.5	59.5	60.6	61.6	58.7
1906...	63.4	64.2	63.8	61.3	55.9	53.5	55.1	59.6	62.7	62.4	61.7	60.1	60.3
1907...	56.9	55.0	56.4	59.6	62.6	62.8	60.5	55.9	51.4	50.3	50.4	50.6	56.0
1908...	50.5	51.6	53.2	51.9	49.9	48.9	49.3	50.5	52.6	53.1	51.9	50.6	51.2
1909...	49.4	46.4	41.6	40.7	42.2	43.3	42.6	40.7	38.2	35.4	33.8	32.8	40.6
1910...	31.5	30.1	29.1	27.7	24.7	20.6	17.6	15.7	14.2	14.0	13.8	12.8	21.0
1911...	12.0	11.2	10.0	7.6	6.0	5.9	5.6	5.1	4.6	4.0	3.3	3.2	6.5
1912...	3.2	3.0	3.1	3.4	3.4	3.4	3.7	3.9	3.8	3.5	3.2	2.8	3.4
1913...	2.6	2.5	2.2	1.8	1.7	1.5	1.4	1.4	1.5	2.3	3.2	3.9	2.2
1914...	4.6	5.0	5.8	6.5	7.4	8.8	......	......	......	......	......	......	......

[1] The present tables extend the records published in Bull., Mount Weather Observatory, 5, pt. 6, 1913, p. 368.

TABLE 3.—*Epochs of sunspot maxima and minima.*

Minima.			Maxima.		
Epochs.	Weight.	Periods.	Epochs.	Weight.	Periods.
		α			α
1610.8	5	....	1615.5	2	....
1619.0	1	8.2	1626.0	5	10.5
1634.0	2	15.0	1639.5	2	13.5
1645.0	5	11.0	1649.0	1	9.5
1655.0	1	10.0	1660.0	1	11.0
1666.0	2	11.0	1675.0	2	15.0
1679.5	2	13.5	1685.0	2	10.0
1689.5	2	10.0	1693.0	1	8.0
1698.0	1	8.5	1705.5	4	12.5
1712.0	3	14.0	1718.2	6	12.7
1723.5	2	11.5	1727.5	4	9.3
1734.0	2	10.5	1738.7	2	11.2
1745.0	2	11.0	1750.3	7	11.6
1755.2	9	10.2	1761.5	7	11.2
1766.5	5	11.3	1769.7	8	8.2
1775.5	7	9.0	1778.4	5	8.7
1784.7	4	9.2	1788.1	4	9.7
1798.3	9	13.6	1805.2	5	17.1
1810.6	8	12.3	1816.4	8	11.2
1823.3	10	12.7	1829.9	10	13.5
1833.9	10	10.6	1837.2	10	7.3
1843.5	10	9.6	1848.1	10	10.9
1856.0	10	12.5	1860.1	10	12.0
1867.2	10	11.2	1870.6	10	10.5
1878.9	10	11.7	1883.9	10	13.3
1889.6	10	10.7	1894.1	10	10.2
1901.7	10	12.1	1906.4	10	12.3
1913.4	10	11.7			

MISTPOEFFER, UMINARI, ATMOSPHERIC NOISES.

The noises long known in Holland as mistpoeffer were much talked of in Europe some 20 years ago, and articles relative to them will be found in the MONTHLY WEATHER REVIEW,[1] including several suggestions as to their possible origin. The noises seemed to come up out of or from the ocean and the waves, fog, or mist; their local names therefore indicated these local theories as to their origin. Similar sounds on Lake Seneca, N. Y., were known as the "Seneca guns;" the fishermen on the Banks of New Foundland knew them as "Seefahrts" "[Sea farts?]"; the similar sounds emanating from the drum fish as kept in our aquaria remind one of the mythical monster known to the Norsemen as Kraken, whose breathings caused the ocean tides. At Cape Haitien there appears to be a mysterious "gouffre" similar to rolling thunder and the Italians sometimes call similar noises "mugito."

Of all the natural methods of producing such sounds, such as distant cannonade or thunder near the coasts, or fog-horn calls reflected from the atmosphere or rocky bluffs, the most likely explanation is the reflection and transmission through the ocean of the booming of heavy surf against a rocky coast. This has now been first proposed by Dr. Terada in the journal of the Meteorological Society of Japan for July, 1915. He made a study of these noises on the southeast coast of Japan, by the use of Helmholtzian resonators, and we can not doubt that he has hit upon the correct explanation for the "mistpoeffer" of Holland and the "uminari" of Japan. The tremendous surf and breakers at Dover, on the rocky shores of Nova Scotia, the destructive "rollers" of St.

[1] Davison, quoted on "barisal guns." Monthly Weather Review, October, 1895, 23: 375.
S. W. Kain, etc., "Seismic and oceanic noises." Ibid., April, 1898, 26: 152-154.
Cancani, quoted on "marina" of Umbria. Ibid., May, 1898, 26: 216.
W. A. Prosser, on the "lake guns" of Lake Seneca, N. Y. Ibid., July, 1903, 31: 336.
C. F. Talman's note on "gouffre," "brontidi," "Nebelknall," etc. Ibid., December, 1907, 35: 575.

Helena and Ascension, must each give rise to sounds that pass through 50 miles or so of water, producing interference maxima and minima as in thunder, and then emerge here and there from the gentle swells of the ocean. Thus a simple natural explanation is found for what has long been a puzzle to science and a mystery to the credulous.—[C. A.]

OCEANIC NOISES; UMINARI.[1]

By T. TERADA.

Oceanic noises, called "uminari" in Japanese, are common phenomena among the littoral of Japan.

On account of their intimate connection with the cyclonic centers, the sounds are observed and recorded at the meteorological stations and are reported to the central observatory in the daily weather telegrams. The oceanic noises resemble the rumbling of a heavy wagon passing over an uneven road or crossing a bridge. They are more distinctly audible at a distance of a few miles from the coast, rather than on the coast itself.

Undoubtedly the oceanic noises are produced by the breakers dashing on the coast, but how the breaking waves produce them is not fully understood. When waves break upon the shore they produce not only aerial vibrations, but also tremors in the ground, which are propagated to some distance; it seems uncertain, however, that these sounds, which are of such relatively short periods, are propagated through the porous ground to considerable distances. The aerial vibrations produced by the tremors of the ground are very small; the noises produced by the air escaping from the breaking waves would have a pretty large amplitude, although they would be somewhat irregular in period. On the shore these noises are confounded with a great variety of other noises, such as the rustling of beach pebbles, the dashing sounds of the water, etc. At a distance from the coast these other noises, having high frequencies, die out, and the oceanic noises, having comparatively long periods, survive.

There are many causes of the comparatively large limit of audibility of the oceanic noises. It is a noteworthy fact that in the case of oceanic noises the source of the sounds is not a single point, but is a line source distributed along the long shore line. In the case of a point source the intensity of the sound decreases in an inverse proportion to the square of the distance from the source. But in the case of multiple sources located along a straight line the case is somewhat different. When the sources produce sound waves of like phase, the resultant wave is cylindrical, and the intensity of the sounds is in simple inverse proportion to the distance. In the case of oceanic noises the sources may be supposed to lie in a straight line, but the waves from the different sources are in differing phases. In this case the intensity of the sound is decreased inversely proportional to the distance. If this simple consideration is approximately correct, the difference between the propagations of the sounds of cannonading and of oceanic noises would be readily explained. The intensity of the sounds from cannonading is reduced to one-hundredth at a distance of 10 fold, but that of the oceanic noises is reduced to only one-tenth at the same distance.

[1] *Reprinted from* Journal Meteorological Society of Japan, July, 1915, 34th year, No. 7.

As a matter of fact, the cause of oceanic noises may not be such a simple one as that described above. Such a simple law may hold to some extent within a radius of a few hundred meters, but when the distance increases to several kilometers or more it is necessary to consider the influence of the distribution of winds and temperatures in the higher atmospheric strata. Here the study of oceanic sounds enters the realm of aerology.

Dr. Terada urges those who have the opportunity to measure the intensity of the oceanic sounds by the "Verdeckungsmethode," and to determine the frequencies by using Helmholtzian resonators, as he did during April, 1915, along the shore at Odawara, on the southwest coast of Honshu, Japan.

CIRRUS BANDS AND THE AURORA.

By DOUGLAS F. MANNING.

[Dated: Alexandria Bay, N. Y., Aug. 3, 1915.]

A condition worthy of noting was observed here Sunday, August 1; in fact, I have seen a similar condition on various occasions, but not so pronounced, showing either a coincidence or connection between the aurora and the cirrus clouds.

On the day mentioned, toward 11 a. m., a belt of cirro-stratus clouds formed in the northern sky about 30° above the horizon, beneath which the sky remained clear. This arch of cloud became quite well defined during the afternoon. Above, long cirrus streamers or mares' tails arose, having their base in the belt of cirro-stratus; in fact the cirrus clouds were taking every appearance of a display of the aurora, the clear space beneath the arch being especially marked. This state of affairs maintained with little change throughout the day, and when darkness came on imagine my surprise in seeing the sky lit up with the aurora, arranged, especially in regard to the arch, almost identical as that of the cirrus clouds. The display, however, did not last long, nor was it but a faint glow, but enough to make one wonder if the strange shapes of the cirrus clouds were in any way controlled by influences which cause the aurora.

[Compare similar observations reported by Birkeland and published in this REVIEW, April, 1914, **42**: 211.—C. A., jr.]

EDDY MOTION IN THE ATMOSPHERE.[1]

By G. I. TAYLOR.

[*Reprinted from* Science Abstracts, Sec. A, May 28, 1915, §536.]

It has been known for a long time that the retarding effect of the surface of the earth on the velocity of the wind must be due in some way to eddy motion, but no detailed calculations appear to have been made on the subject. The present paper deals with the effect of a system of eddies on the velocity of the wind and also on the temperature and humidity of the atmosphere. Considering first the propagation of heat in a vertical direction the ordinary conductivity of heat by molecular agitation is extremely small, but a more potent effect may be produced by vertical transference of air, which retains its heat as it passes into regions where the potential temperature differs from that of the layer from which it

[1] See Phil. Trans. Royal Society, 1915, **215**: 1-26.